

CONTRACT NAS 9-17249
BASELINE CONFIGURATION
DATA SET

NASA STANDARD INITIATOR - 2
(NSI - 2)

(NASA-CR-172071) BASELINE CONFIGURATION
DATA SET: NASA STANDARD INITIATOR-2 (NSI-2)
(Roberts Research Lab.) 19 F CSCI 19A

N89-11050

63/28 Unclass
0154964

APPROVED BY



DATE

6/15/88

ROBERTS RESEARCH LABORATORY



POTASSIUM PERCHLORATE
3 MICRON PARTICLE SIZE

Potassium Perchlorate per MIL-P-217, Class 4	40 grams
2-Propanol	800 milliliters
Distilled Water	250 milliliters

Dissolve potassium perchlorate (40 grams) in boiling water (250 milliliters).

When the potassium perchlorate is completely dissolved in the water, pour the potassium perchlorate/water solution into the 2-Propanol (800 milliliters) while it is being highly agitated by a high speed (air driven) mixer.

Decant, filter and dry the potassium perchlorate. Particle size should be 3 microns.



BASE CHARGE COMPOSITION

Zirconium	-325 mesh	100 grams
Potassium Perchlorate	3 micron particle size	94 grams
Viton-B		6 grams

Using magnetic stirrer, dissolve Viton-B (6 grams) in acetone (150 milliliters) in a 400 milliliter Pyrex beaker. Time required is approximately one (1) hour.

Add hexane (108 milliliters). Continue to stir for ten (10) minutes.

Transfer to high speed (air driven motor) mixer.

Add potassium perchlorate (94 grams) and mix for five (5) minutes.

While mixing, over a ten (10) minute period slowly add zirconium (100 grams). Mix for ten (10) minutes, stopping mixer and scraping down sides with a Teflon policeman every two (2) minutes.

Shock gel by rapidly adding hexane (217 milliliters) while mixing. Continue to mix for thirty (30) seconds after all hexane is added.

Remove from mixer and filter and wash with hexane (150 milliliters); then dry at room temperature.

Screen through a 20 mesh stainless steel screen.

Thoroughly dry in oven at +175° F for four (4) hours.

Store in Velostat jar.



PRIMER CHARGE COMPOSITION

Zirconium	-325 mesh	9.8 grams
Potassium Perchlorate	3 micron particle size	9.4 grams
Thermodur Y-338 Resin *		0.8 grams
Xylene		6.1 grams

Final Solid Weight Percentages (After Baking and Drying)

Zirconium	50.04%
Potassium Perchlorate	48.00%
Thermodur Y-338 Resin	1.96%

Using a magnetic stirrer, mix Thermodur Y-338 resin (0.8 grams) with xylene (6.1 grams) in a 250 milliliter Teflon beaker with a bare 3/8" Alnickel 5 magnet for five (5) minutes.

While mixing, add potassium perchlorate (9.4 grams) slowly until it is evenly dispersed. Mixing time is approximately 30 minutes.

Add small amounts of zirconium slowly (9.8 grams total) while mixing. Scrape down sides of beaker with Teflon policeman every ten (10) minutes. Mixing time is approximately thirty (30) minutes.

Store in bottles with Teflon lined caps.

Approximately ten (10) milligrams is used in each NSI-2 initiator. Theoretically, two thousand (2,000) initiators can be manufactured from a twenty (20) gram batch of the primer charge composition.

* NOTE: Thermodur Y-338 is composed of 48% non-volatiles. This resin was used in the electric initiators on the Mercury and Gemini programs.



DEPOSITION OF TITANIUM BRIDGE

The deposition system was as shown in Figure I. The source consisted of three tungsten wires, 0.040" diameter and 10.5" long, which were twisted together. The tungsten braid was then closely wrapped with commercially pure 0.031" diameter titanium wires. The distance between the source and the substrate was 3.9".

The NSI-2 units were screwed into their holder, which was an aluminum tube 8" in diameter and 10" long. The holder was fitted with stainless steel mica band heaters at each end. The tube was drilled, tapped and ported so that there were five rows of 24 holes per row.

A thermocouple was tightly clamped against the aluminum tube in its center area and at least one set of high temperature leads was attached to the pins of a randomly selected NSI-2 unit after it was installed in the holder.

The system was closed and vacuum pumpdown was begun. At 10^{-3} Torrs, the band heaters were turned on and set for a temperature of $+500^{\circ}$ F. The voltage was set at 120 volts. Liquid nitrogen was then added to the cold trap.

The pressure did not drop much below 1×10^{-4} Torrs until after the aluminum tube and the NSI-2 units reached $+500^{\circ}$ F. At that point, degassing appeared to stop and the units could be pumped on down. At 1×10^{-5} Torrs, the source was turned on and set at 75 amps.

After a period of the source degassing, the pressure continued downward. At a pressure of 1×10^{-6} Torrs, the source current was turned up to 90 amps and another short period of degassing followed.

When degassing stopped and the pressure again dropped down to 1×10^{-6} Torrs, the current was turned up to 120 amps. At this point, the titanium melted, flowed over the tungsten wires and began rapidly evaporating. The time from start of evaporation (resistance of 100,000 ohms between the pins of the NSI-2 units) until the point when the unit with its leads reached a resistance of 1.55 ohms was approximately six (6) minutes.

At this resistance of 1.55 ohms, the source was turned off, the heater bands were turned off and the units were allowed to cool in vacuum. When the units had reached a temperature of $+300^{\circ}$ F, the vacuum chamber was vented and the system opened to air exposure to



accelerate cooling.

The depositing final resistance at $+500^{\circ}$ F with a lead resistance of 1.55 ohms resulted in a bridge resistance of $1.05 \text{ ohms} \pm 0.1 \text{ ohms}$ at $+70^{\circ}$ F in approximately 80% of the trial units. Upon microscopic examination, it was determined that the units which failed to meet the criteria of $1.05 \pm 0.1 \text{ ohms}$ exhibited poor grinding of the substrate surface. When the units were reground and again subjected to the vacuum metallizing process, the proper bridge resistance resulted.



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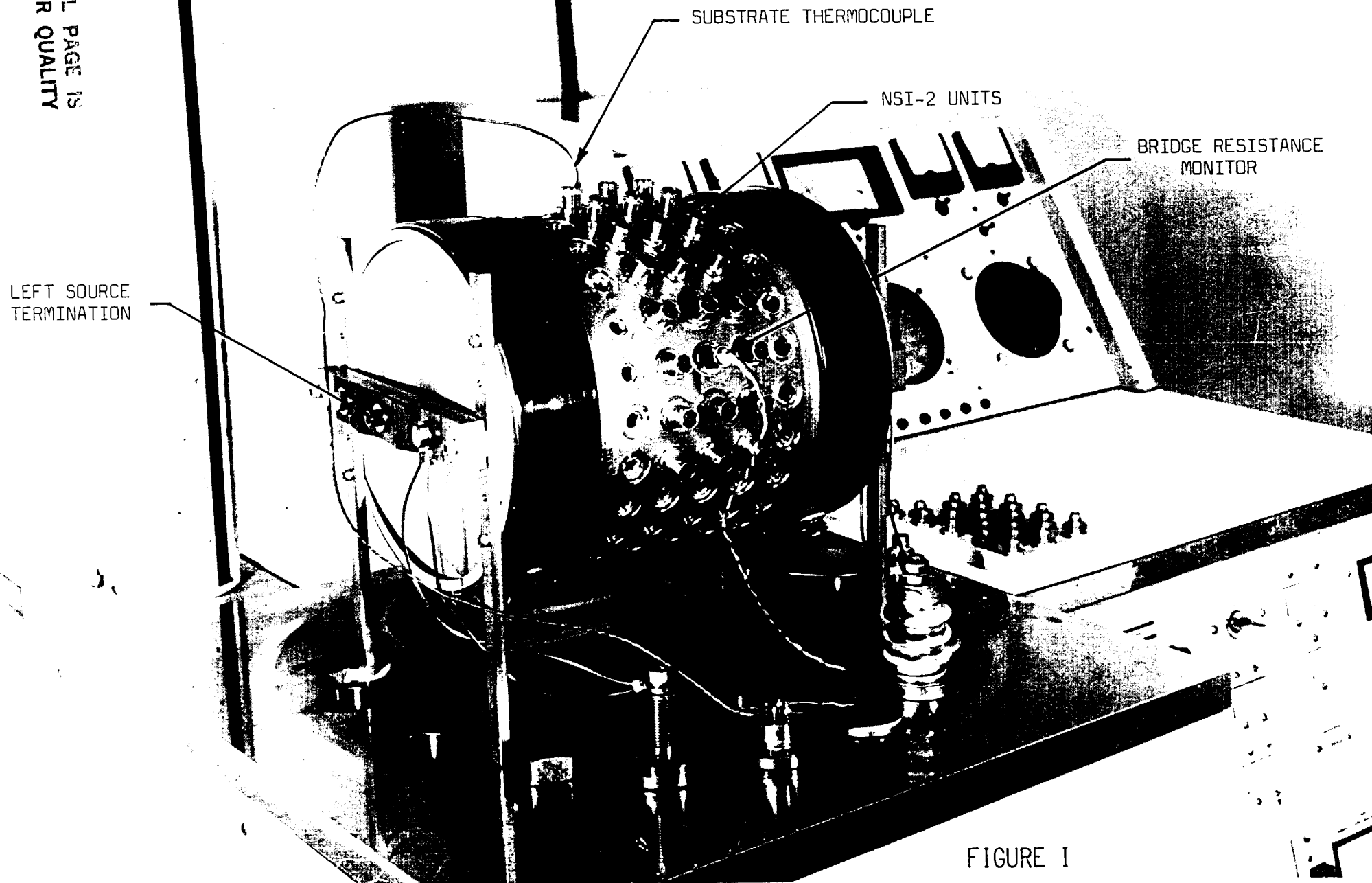
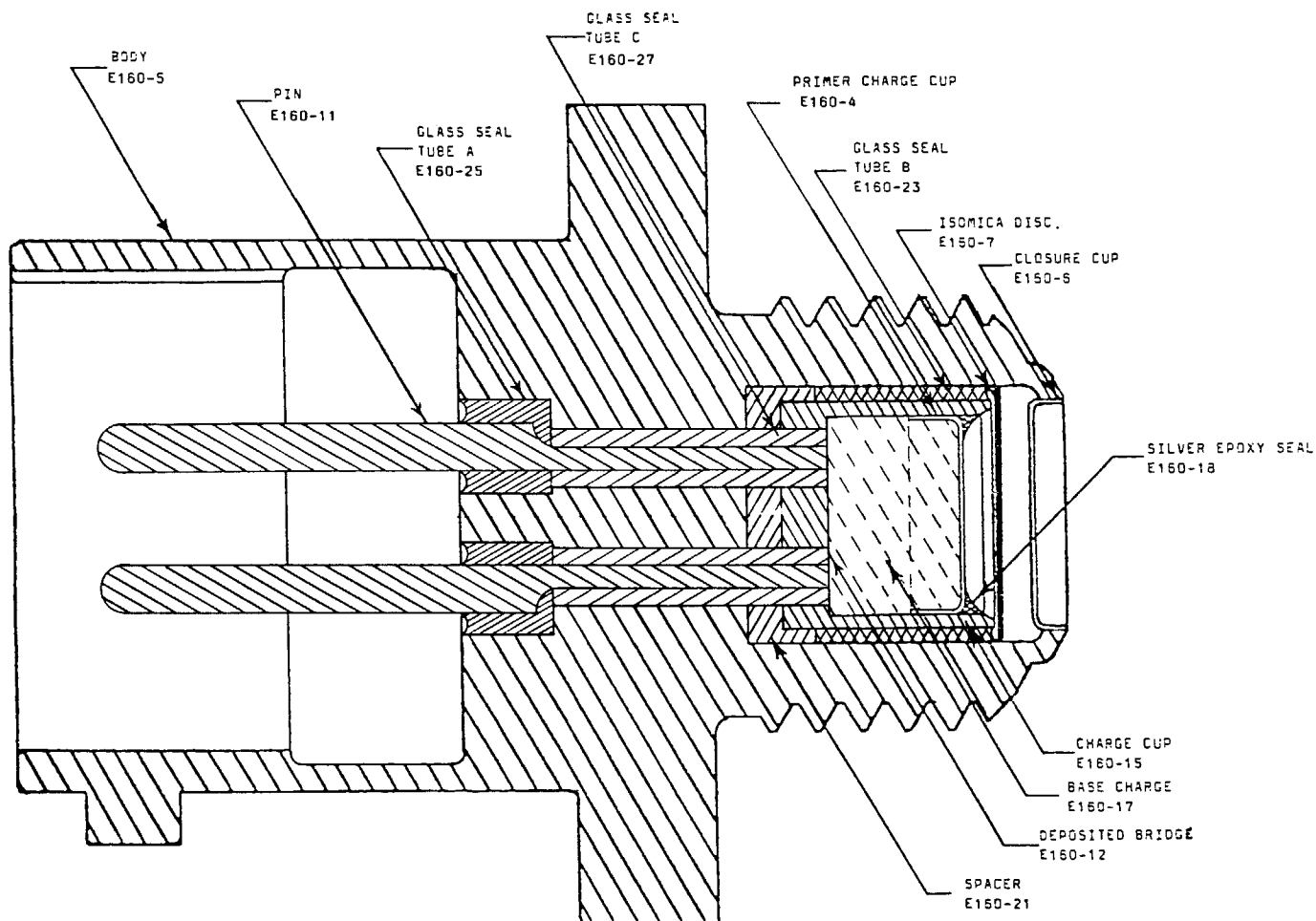
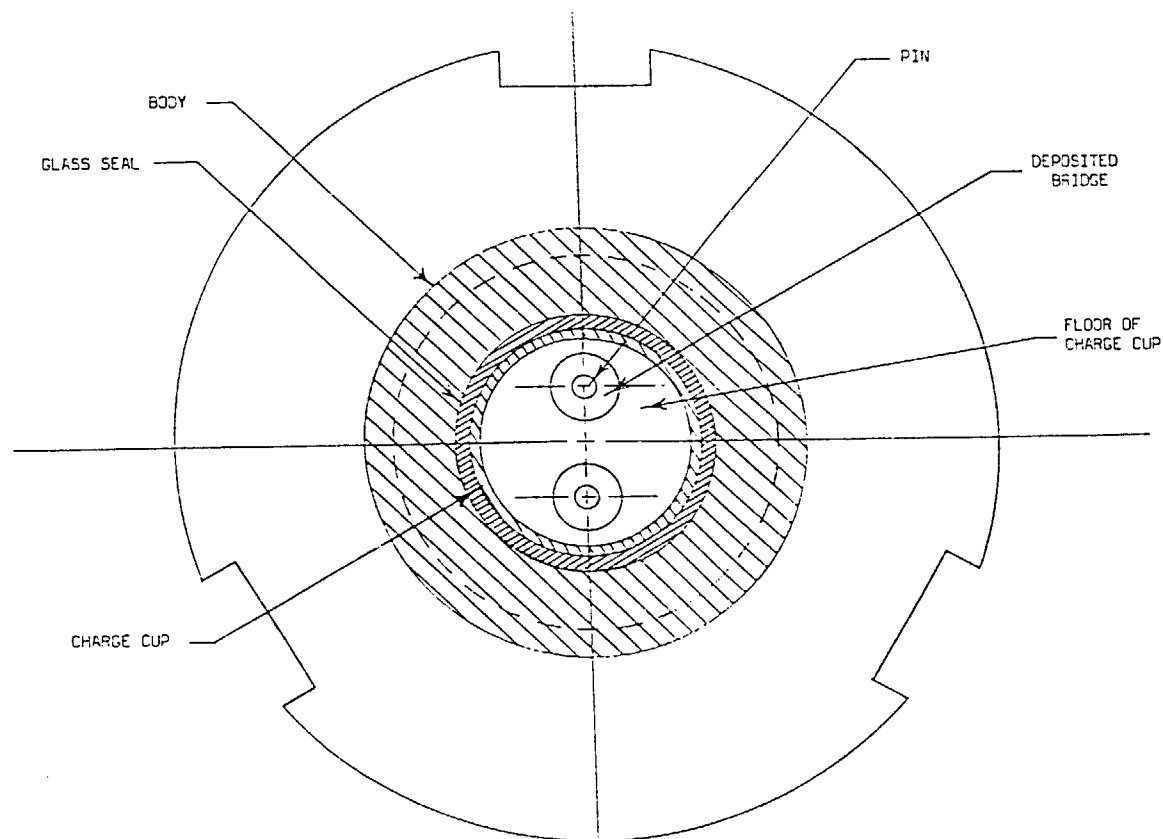


FIGURE I



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DEC. ±		DRAWN BY: <i>acc</i>	SCALE: 10/1
ANGLES ±	DEG.	APPROVED BY: <i>acc</i>	DATE: 1/6/83
CONCENTRICITY	T.I.R.		
FINISH	R.M.S.		
NSI - 2		DRAWING NUMBER C160-16	



SECTION BB

VIEW WITH PRIMER AND BASE CHARGE REMOVED

DRAWING TOLERANCES
UNLESS OTHERWISE
SPECIFIED

DEC. \pm _____

ANGLES \pm _____ DEG.

CONCENTRIC _____ T.I.R.

FINISH _____ R.M.S.

ROBERTS RESEARCH LABORATORY
23150 KASHIWA COURT
TORRANCE, CALIFORNIA 90505-4027

DRAWN BY: *ARR*

SCALE:

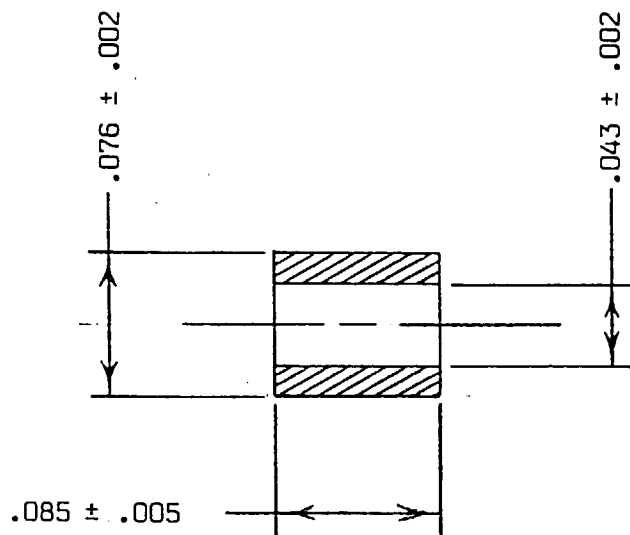
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DATE: 5/4/88

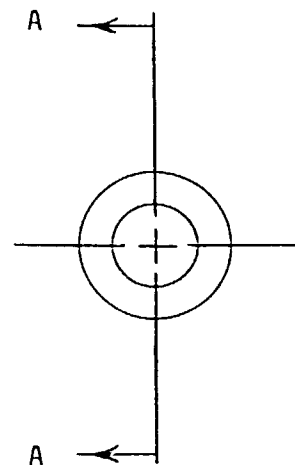
DEPOSITED BRIDGE LOCATION

DRAWING NUMBER

D160-5



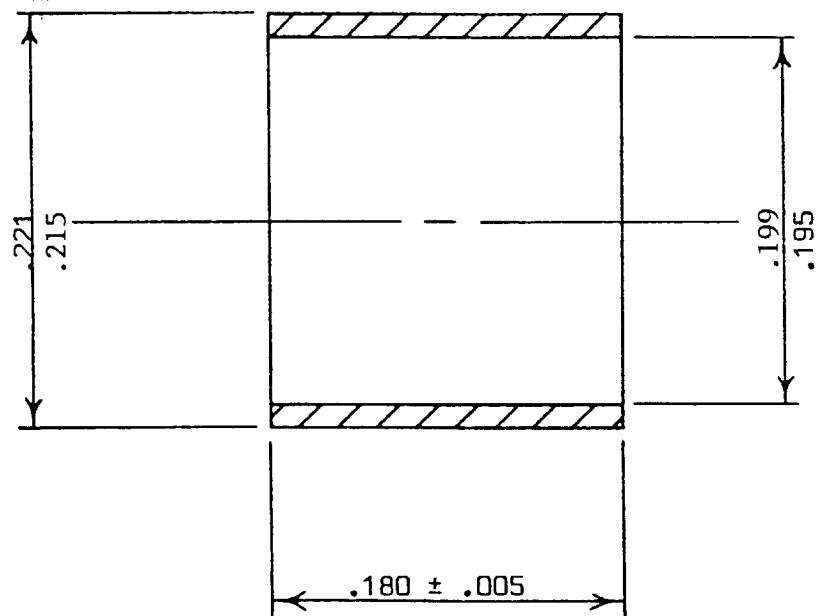
SECTION AA



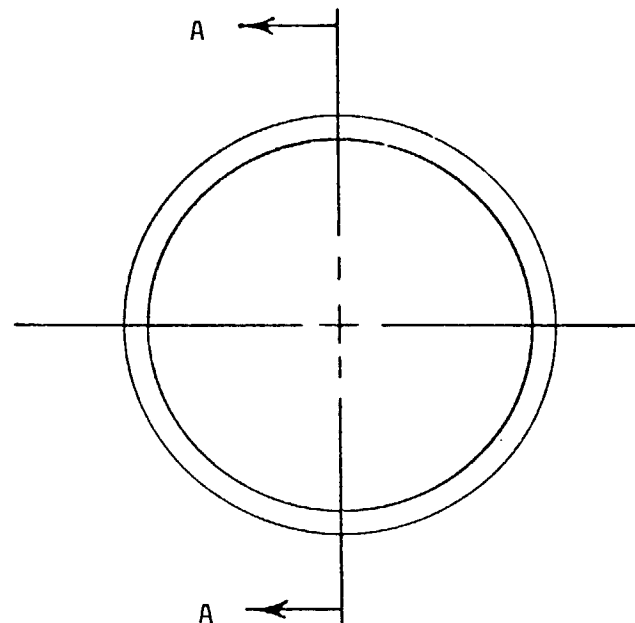
NOTES

1. MATERIAL: GLASS #980

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED		ROBERTS RESEARCH LABORATORY	
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ANGLES ± _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY .003 T.I.R.		DRAWN BY: <i>ADR</i>	SCALE: 10/1
FINISH _____ R.M.S.		APPROVED BY: <i>ADR</i>	DATE: 11/20/87
GLASS SEAL TUBE A			DRAWING NUMBER E160-25



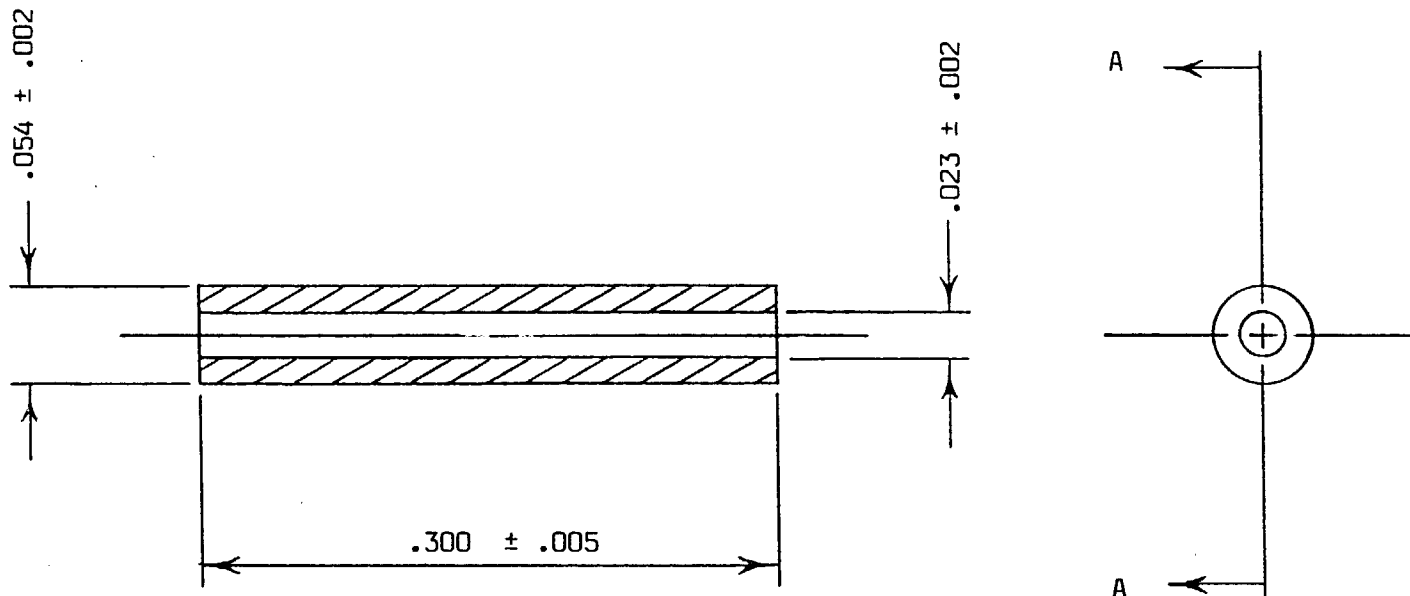
SECTION AA



NOTES

1. MATERIAL: LEAD GLASS, KG-12.

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED DEC. \pm _____ ANGLES \pm _____ DEG. CONCENTRICITY $\pm .003$ T.I.R. FINISH _____ R.M.S.		ROBERTS RESEARCH LABORATORY 23150 KASHIWA COURT TORRANCE, CALIFORNIA 90505-4027	
DRAWN BY: <i>ASR</i>		SCALE: 10/1	
APPROVED BY: <i>ASR</i>		DATE: 3/4/85	
GLASS SEAL TUBE B			DRAWING NUMBER E160-23

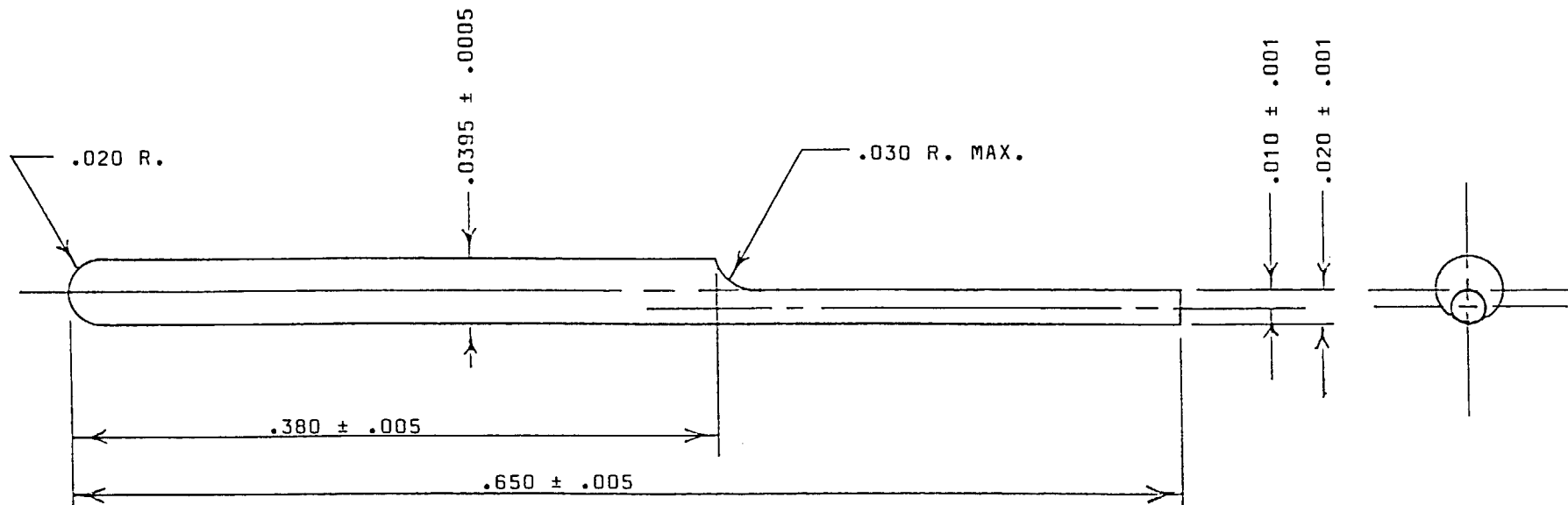


SECTION AA

NOTES

1. MATERIAL: GLASS #980.

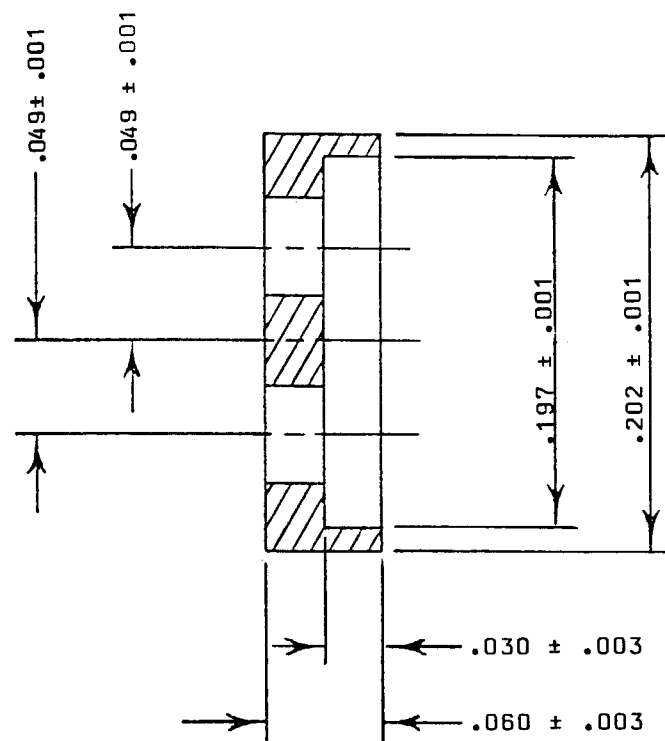
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ANGLES \pm _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
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GLASS SEAL TUBE C			DRAWING NUMBER E160-27



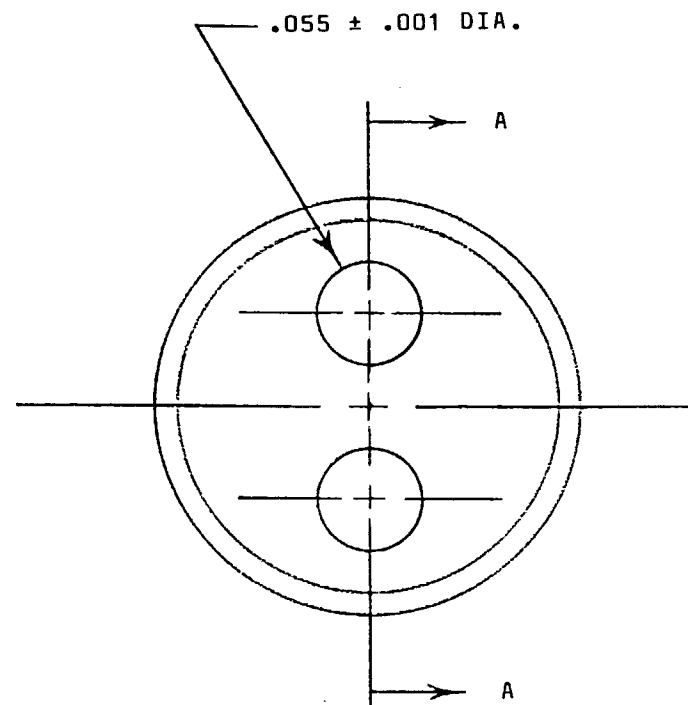
NOTES

1. MATERIAL: 28% CHROMIUM IRON
CARPENTER 27

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED		ROBERTS RESEARCH LABORATORY	
DEC. ± _____		23150 KASHIWA COURT	
ANGLES ± _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY _____ T.I.R.		DRAWN BY: <i>ASR</i>	SCALE: 10/1
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PIN			DRAWING NUMBER E160-11



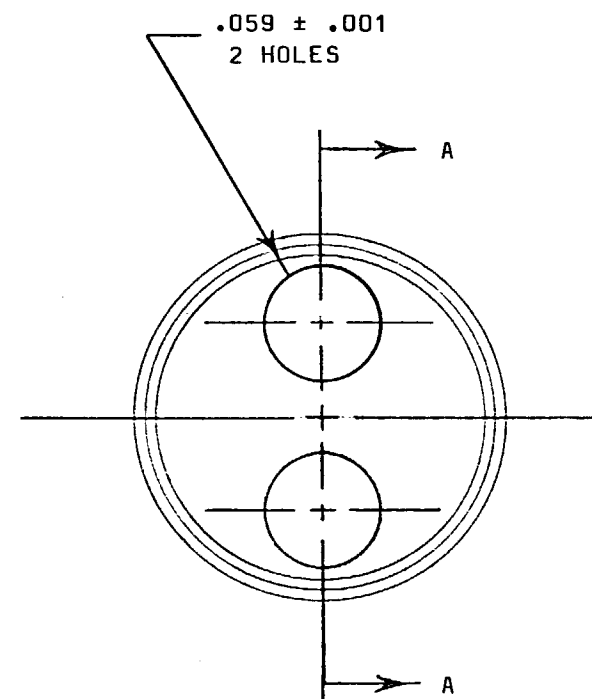
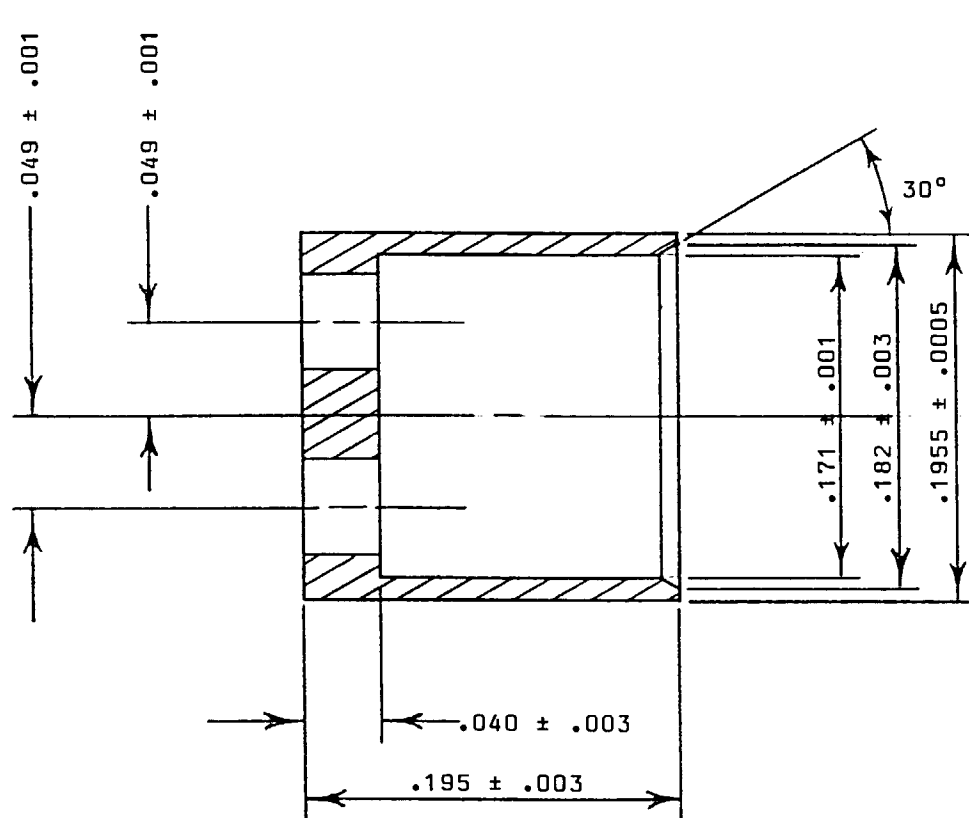
SECTION AA



NOTES

1. MATERIAL: "MACOR" GLASS CERAMIC.

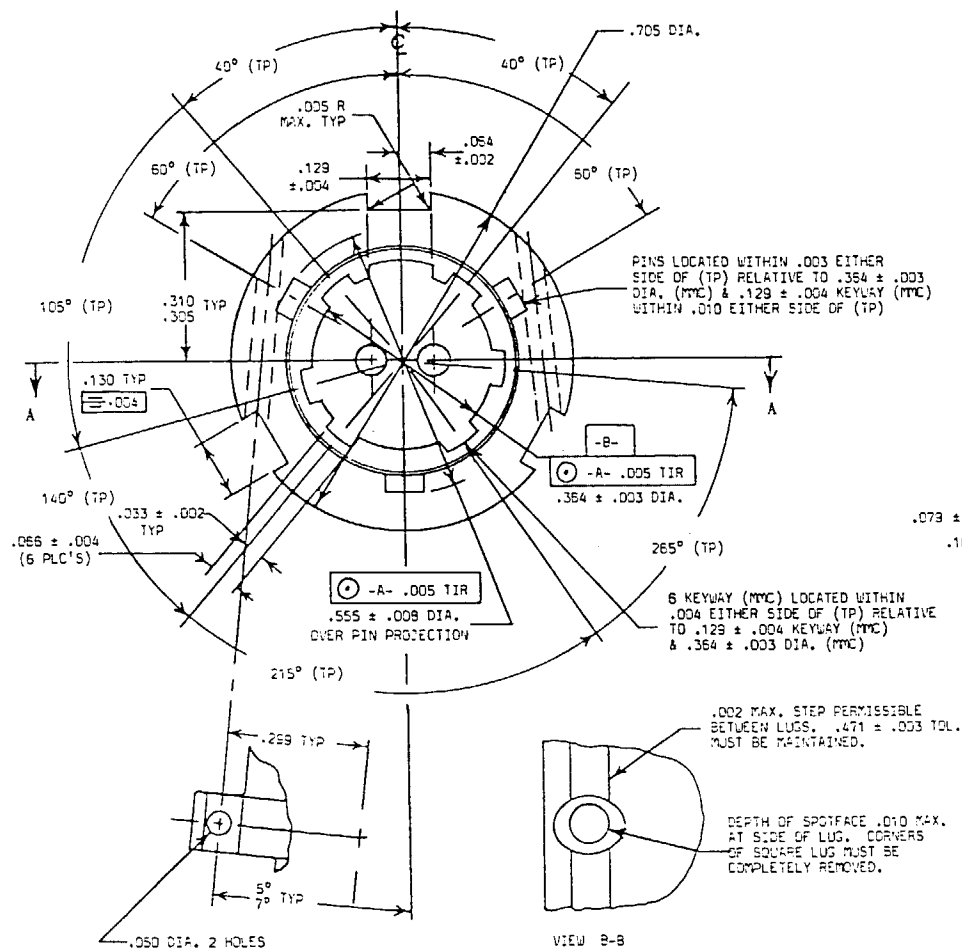
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ANGLES \pm _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY $.002$ T.I.R.		DRAWN BY: <i>ASR</i>	SCALE: 10/1
FINISH 63 R.M.S.		APPROVED BY: <i>ASR</i>	DATE: 11/3/87
SPACER			DRAWING NUMBER E160-21



NOTES

1. MATERIAL: 446 STAINLESS STEEL.
2. BREAK SHARP EDGES .005 MAX. AND REMOVE ALL BURRS.

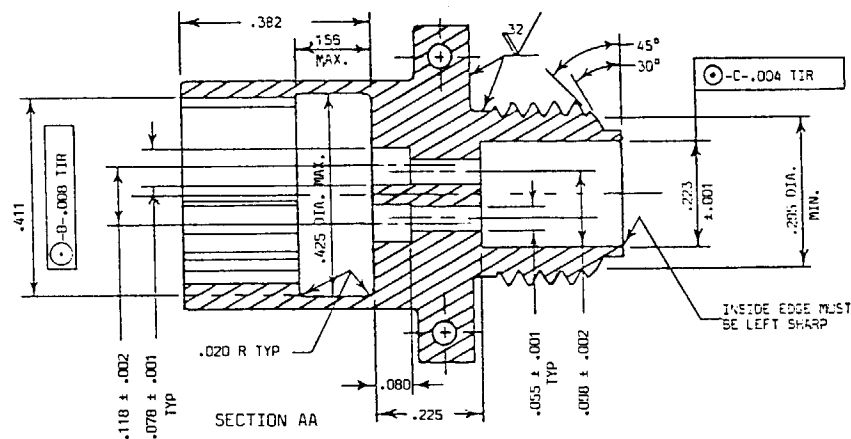
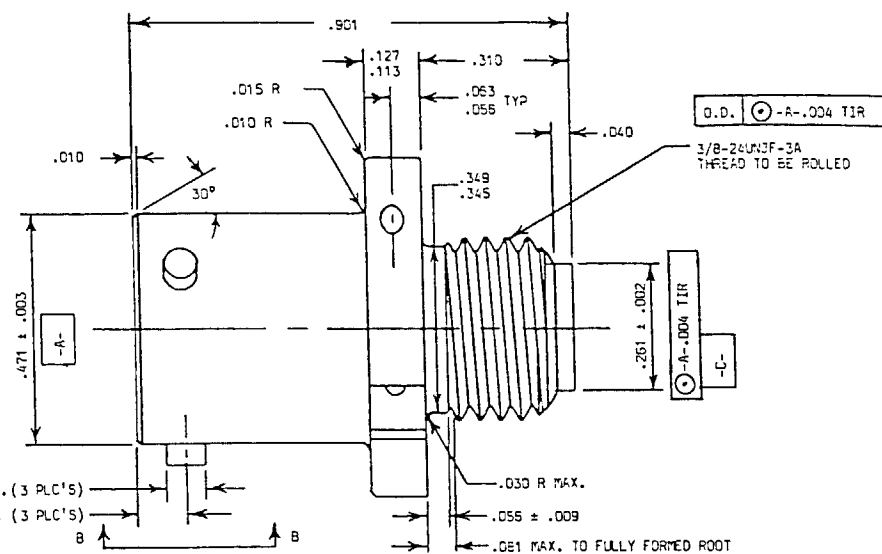
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ANGLES \pm _____ DEG.		DRAWN BY: <i>ASR</i>	SCALE: 10/1
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CHARGE CUP			E160-15



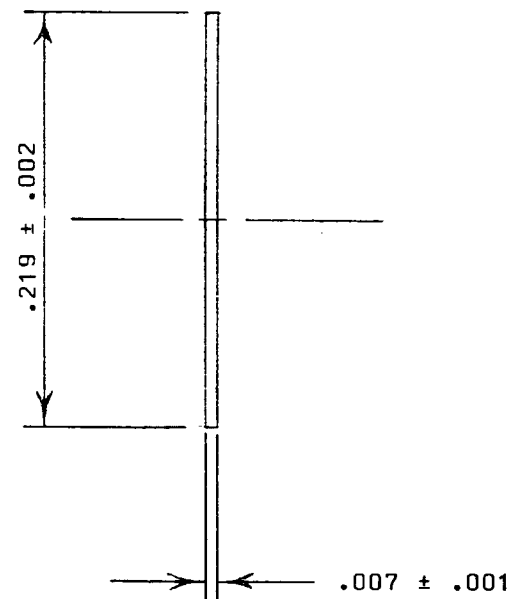
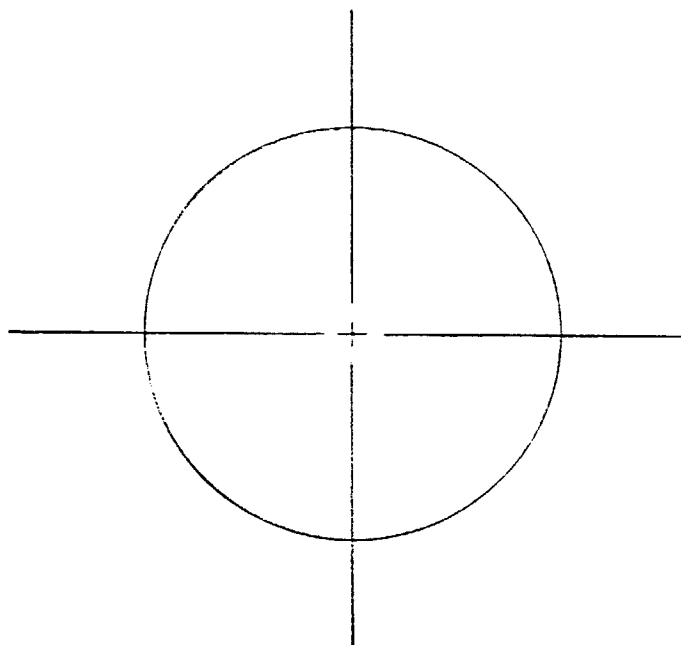
NOTES

1. INTERPRET DWG PER DOD-STD-100.
2. MATERIAL: INCONEL 718 SOLUTION HT.
3. DEFINITIONS: (TP)-TRUE POSITION & (MMC)-MAX. MATERIAL CONDITION.
4. THREADS SHALL BE ROLL-FORMED TO MIL-S-8879 CONTOUR BEFORE PRECIPITATION HARDENING HEAT TREATMENT.
5. AGE HARDEN TO 185 TO 220 KPSI TENSIL IN ACCORDANCE WITH PARAGRAPH 3.4.1.2 OF AMS 5662C.
6. RELATIONSHIP OF WRENCHING SLOTS TO BAYONET PINS AND KEYWAYS IS IMMATERIAL AND NEED NOT BE CONSISTENT IN ANY LOT.
7. REMOVE ALL BURRS AND SHARP EDGES .005-.015 UNLESS OTHERWISE SPECIFIED.

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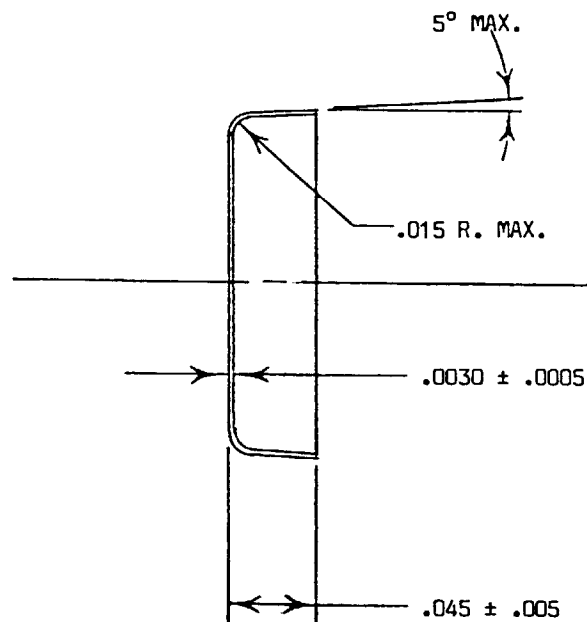
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DEC. ± .005	ANGLES ± 2 DEG.	DRAWN BY: <i>OCR</i>	SCALE: 4/1
CONCENTRIC ± .005 T.I.M.	FINISH 63 R.M.S.	APPROVED BY: <i>OCR</i>	DATE: 12/7/87
BODY		DRAWING NUMBER E160-5	



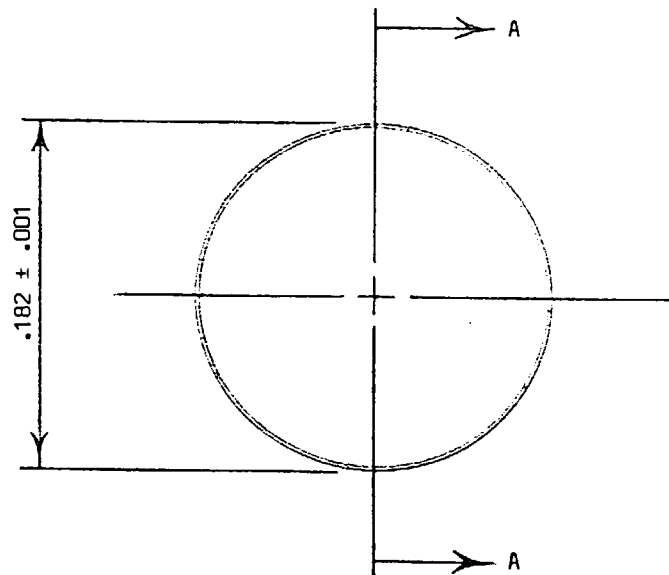
NOTES

1. MATERIAL: ISOMICA CAT. NO. 4351-7 CLASS H
U.S. SAMICA CORP.

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED		ROBERTS RESEARCH LABORATORY	
DEC. ± _____		23150 KASHIWA COURT	
ANGLES ± _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY _____ T.I.R.		DRAWN BY: <i>ASR</i>	SCALE: 10/1
FINISH _____ R.M.S.		APPROVED BY: <i>ASR</i>	DATE: 8/6/86
ISOMICA DISC			DRAWING NUMBER E160-7



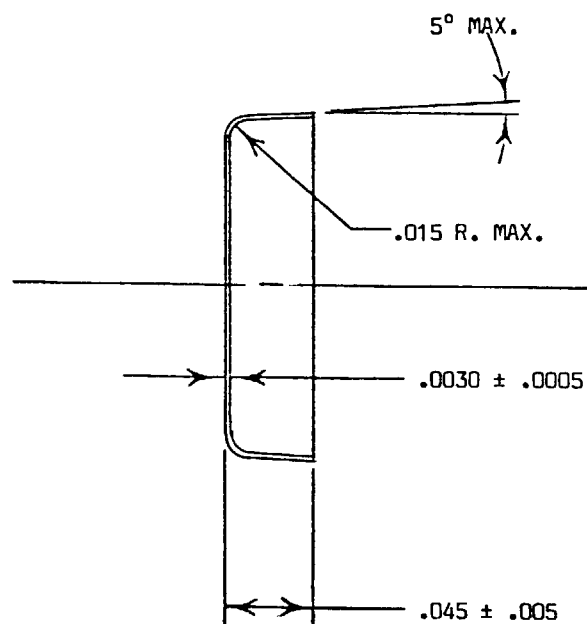
SECTION AA



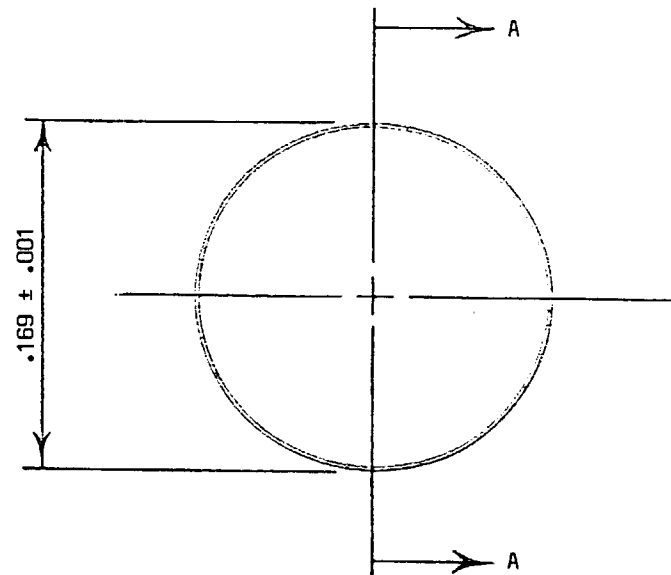
NOTES

1. MATERIAL: 316L STAINLESS STEEL, ANNEALED.
2. PASSIVATE PER MIL-S-5002.

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED		ROBERTS RESEARCH LABORATORY	
DEC. ± _____		23150 KASHIWA COURT	
ANGLES ± _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY _____ T.I.R.		DRAWN BY: <i>ASR</i>	SCALE: 10/1
FINISH _____ R.M.S.		APPROVED BY: <i>ASR</i>	DATE: 8/6/88
CLOSURE CUP			DRAWING NUMBER E160-6



SECTION AA



NOTES

1. MATERIAL: 316L STAINLESS STEEL, ANNEALED.
2. PASSIVATE PER MIL-S-5002.

DRAWING TOLERANCES UNLESS OTHERWISE SPECIFIED		ROBERTS RESEARCH LABORATORY	
DEC. ± _____		23150 KASHIWA COURT	
ANGLES ± _____ DEG.		TORRANCE, CALIFORNIA 90505-4027	
CONCENTRICITY _____ T.I.R.		DRAWN BY: <i>CCR</i>	SCALE: 10/1
FINISH _____ R.M.S.		APPROVED BY: <i>CCR</i>	DATE: 12/11/87
PRIMER CHARGE CUP			DRAWING NUMBER E160-4

